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1. SPUTUM SHAKING AND SEDIMENTING APPARATUS.
2. A RABIES COLLECTING OUTFIT.

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I. APPARATUS FOR SHAKING AND SEDIMENTING SPUTUM SPECIMENS.

A. *The shaking of sputum.*—Anyone who has had occasion to make many examinations of sputum for tubercle bacilli appreciates the difficulty in uniformly securing a good even smear, thick enough to present a fair sample of the particular specimen under examination, yet not so thick as to obscure the light or jeopardize the chances of finding the organism if present. If the specimen be chiefly mucous in character the difficulty in obtaining caseous particles imbedded therein is greatly increased, and often it is only by the exercise of the greatest patience and care in manipulation that satisfactory results are obtained. One often has an uncomfortable feeling, in cases where the clinical signs are fairly well marked but where bacteriological results are negative, that the organisms are probably present in the lungs, but are being raised in only very small numbers and have escaped observation.

To overcome the difficulty in smearing and at the same time to increase the efficiency of the examination of sputum, it occurred to the writer to investigate the value of digesting, shaking, and sedimenting the specimens.

It was at once apparent that unless the entire process was carried out in the small one-ounce bottles supplied by the laboratory, manipulations would become tedious and confusion of samples might take place. Moreover to secure a complete breaking up of all particles and a resulting homogeneous mixture a rapid short stroke was necessary. A vertical position for the bottle and for the direction of the stroke had the advantage of being convenient and at the same time gave more distance for the contents of the bottle to travel than a simple horizontal motion. Since all shaking machines on the market gave either a long stroke, worked horizontally, or were unavailable for the purpose in hand, the following apparatus was devised:

On an iron platform 14 x 10 inches is mounted a steel shaft running from the center lengthwise to one end, where a heavy flywheel is hung, the platform being raised from the floor by short iron legs. In the center of the platform a truncated metal cone is bolted the two connecting surfaces having a ground joint.

On the top of the truncated cone a steel cylinder is mounted by means of a threaded joint, the cylinder being capped by a steel disc riveted to the sides. The center of this disc or plate is cut out to receive a piston-rod of about the same length as the cylinder. The piston-rod is attached at its lower end to a connecting rod, which in turn is joined to the shaft. The lower joint runs in oil, while the upper joint is splashed with oil when the machine is running. About midway of the piston rod a plate is attached which fits the cylinder closely and which supports a flat steel spring. As the piston rises, air is compressed between this plate and the cap of the cylinder and escapes through several small valve holes in the sides, this together with the spring reducing the jolt of the upward stroke to a minimum.

A second-steel cylinder, to which is attached a broad platform carrying small metal cups, slides upon the inner cylinder. The top of the outer cylinder is capped and the cap is bolted to the top of the piston rod, an up-and-down motion thus being conveyed to the outer cylinder and the platform. As the outer cylinder rises, an air space is formed between the cap of the outer and that of the lower cylinder. The jolt of the downward stroke is thus absorbed in the same manner as that previously described for the upward stroke. The machine can be either directly connected with a small motor, or belt driven. A speed of 500 strokes per minute for from five to ten minutes has been found satisfactory.

At one side of the platform a short lever is provided to drive the stoppers of the sputum bottles home, the same level being obtained with each one by means of a small stop fitted with a milled thumbscrew. The bottles fit snugly in the metal cups provided on the platform, and are held in place by a heavy metal cap-plate which fits over the top of the outer cylinder and which is fastened down by two small thumbscrews.

By means of this apparatus all masses coagulated by the 5 per cent carbolic acid sent out in the bottles and all caseous particles in the sputum are rapidly broken up and the sputum rendered homogeneous throughout. The time necessary to smear a dozen specimens properly is materially reduced, and the smears are more even and less apt to flake.

A sufficient number of comparative tests has been made to show that the total number of positives is increased somewhat by this method.

Out of 1,000 specimens examined 212 were positive both before and after shaking. Four samples gave positive results before shaking and negative results after, while 10 gave negative results before and positive results after shaking.

In other words there is a loss of about 1.7 per cent in positive

results by shaking, but also a gain of about 4.5 per cent, giving a total gain of about 2.8 per cent.

The only explanation for the decrease after shaking that the writer has to offer is that possibly if only a very few bacilli are present, say, for instance, in a single caseous particle, this might be fished for and obtained before shaking, but the organisms after shaking might be so scattered as to be missed entirely.

Note was made in every case where there was a comparative increase or decrease in the number of bacilli present. In 29 cases there was an increase and in 10 a decrease in the relative quantity of organisms present.

One would naturally not expect the increase in the total number of positive specimens to be large, since a considerable number of specimens are undoubtedly submitted on very slight suspicion, thus giving a large percentage of negatives. On the other hand a diagnosis made earlier than was hitherto possible, even if on only a very few samples, is of considerable value to the persons concerned, in the light of our present knowledge.

If a small amount, from 1 to 2 per cent, of a 10 per cent aqueous solution of caustic soda is added previous to the shaking, digestion of the mucous takes place very quickly, rendering the smearing, etc., still easier. Such digestion is necessary if the sputum samples be sedimented.

B. The sedimenting of sputum.—The problem of properly sedimenting the sputum in the original bottles was far more easily solved than that of shaking. Any Babcock machine having a speed of 1,200 revolutions per minute or over does fairly well, provided the sputum bottles used are small enough to fit into the Babcock cups. More uniformly satisfactory results can be obtained with a speed of 2,000 or over. In the machine used by the writer the cups are held in place by trunnions which fit into the slots in a metal head or pronged disc. The regular cups can thus be taken out and special cups of the exact size to receive the sputum bottles inserted.

Lack of time has prevented the presentation at this time of some of the minor details of the method, such as the most advantageous amount of digestive solution to add, the speed, and length of time necessary to obtain the best results. It is the intention of the writer

to determine these points and to secure evidence as to the relative efficiency of this as compared with ordinary methods of examination. Enough has been done to indicate that very satisfactory results may be obtained.

II. A COLLECTION CASE FOR RABIES SPECIMENS.

Rabies first developing in the western part of Massachusetts in the fall of 1905, and becoming epidemic in Boston in the spring of 1906, it became necessary to have some convenient way of severing the head of the supposed infected animal at the spot where it was killed and of conveying the same back to the laboratory. The following answers the purpose well:

A tin-lined copper box 18 inches long by 8 inches wide and $9\frac{1}{2}$ inches deep is divided off at one end into two small compartments. These two compartments are made by running a partition $3\frac{1}{2}$ inches from the end of the box and a second lengthwise partition $3\frac{1}{2}$ inches from the front of the box. The smaller space is designed to carry a one-pint bottle of 5 per cent carbolic acid. The second small compartment is a convenient place for rubber gloves, a bottle of chloroform, etc. The remaining large compartment will easily hold the head of a Newfoundland, St. Bernard, or other large dog. The hinged cover of the box is heavily reinforced and fits down upon a wired edge. On the inner part of the cover are metal clamps, holding a saw and dissecting knife. When closed the cover is held in place by two sliding clasps and a hasp and padlock. A tubular brass handle is firmly fastened to the cover. The complete case is of suitable size and weight for easy transportation. As every part of the box is of metal it can be sterilized by placing on a piece of sheet iron over a two-burner gas stove, filling the box partly full of water and boiling.

When many cases are to be examined, the convenience of such a box as that just described is evident. An untrained laboratory assistant may be sent out with the box, the head of the suspected animal removed, placed in the box, and brought back to the laboratory in public conveyances, if necessary, without the delay of waiting for the express, and without the necessity of disposing at the laboratory of the rest of the carcass.

PLATE I.

